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ABSTRACT

This curriculum resource guide, one of seven developed by the State of Illinois to present information on new and emerging curricula existing in the nation, can be used as a basis for local educators to determine the resources needed to offer industrial hygiene technician curricula and to initiate curriculum development at the local level. Chapters 1 and 2 contain an introduction and procedures for using the guide. Chapter 3 describes the job duties and typical employers of industrial hygiene technicians. In chapter 4 alternative curriculum approaches are presented--an associate degree program and certificate program. Chapter 5 discusses these resources required to implement the program: curriculum advisory committee, facilities and equipment, and instructor qualifications. The final chapter contains fifteen abstracts of curriculum and instructional materials: information provided includes title, author(s), availability, and price. Appendixes include lists of schools offering coursework in industrial hygiene, related agencies/organizations and journals/periodicals, and equipment lists and inventories. (A report of the project that identified the seven new and emerging occupations is available as CE 025 423. See Note for other curriculum resource guides in ERIC.) (YLB)

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INDUSTRIAL HYGIENE TECHNOLOGY: A CURRICULUM PLANNING AND RESOURCE GUIDE

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PREFACE

In 1978 CONSERVA, Inc. was awarded a contract by the Illinois Department of Adult, Vocational, and Technical Education (DAVTE) to identify new and emerging occupations within the State and to determine the types, levels, and distribution of new vocational education curricula which are needed to meet the employment demands for skilled workers in those occupations. To accomplish the objectives of the project, CONSERVA staff undertook a search for potential new occupations through a review of similar national research efforts, recently enacted Illinois legislation, and technical and trade journals. Telephone contacts to identify new and emerging occupations were made with over 450 individuals nationwide, representing industries, educational institutions, professional and trade associations, government agencies, labor unions, service organizations, and private employers.

Through these cumulative efforts, seven occupations were identified which met pre-determined criteria defining new and emerging occupations, i.e., 1) the occupation has come into existence within the past decade; 2) the occupation is skilled or technical in nature, requiring at least six months of vocational education preparation but less than a four-year college program; 3) there are no or limited vocational education programs within Illinois which are preparing students to enter the occupation and 4) information is currently available which reflects an anticipated shortage of workers within the State over the next five years. The seven identified new and emerging occupations are:

- Biomedical equipment technician
- Industrial hygiene technician
- Podiatric assistant
- Therapeutic recreation technician
- Swine confinement facility assistant manager
- Solar energy technician
- Halfway house manager

In order to hasten the inauguration of curricula for these new and emerging occupational areas, the Illinois Department of Adult, Vocational and Technical Education (DAVTE) awarded a second contract to CONSERVA. The purpose of that project was to locate new and emerging curricula that are currently in existence in the nation, to obtain available curriculum documentation for each of the seven occupational areas and to incorporate that information into seven curriculum resource guides. This volume represents one of the products of that effort, a curriculum resource guide which can be used as a basis for initiating a curriculum for preparing Industrial Hygiene Technicians.

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I. INTRODUCTION

Industrial Hygiene Technicians assist industrial hygienists in the measurement, analysis and control of potential health hazards in work environments and, to a lesser extent, in the community. Until recently, the job duties of the technicians were performed by undergraduate or graduate-degreed industrial hygienists , safety professionals, chemists or professional support personnel who also performed other job duties. Within the last five years or so the job duties have been recognized as those of full-time industrial hygiene technicians.

The field of industrial hygiene is expanding both within Illinois and across the nation, primarily due to current and anticipated industrial health standards and regulations established by the Occupational Safety and Health Administration. From 1977 to 1978, the number of industrial hygienists in Illinois increased by 16 percent. Annual increases were projected to be 12 percent over the next five years (1978-1983). A recent study estimated that there will be a demand in this same period for two to five industrial hygiene technicians for each industrial hygienist (Spetz, et. al.). As a result, the most recent projections indicate that within Illinois an additional 508 to 1,278 industrial hygiene technicians will be needed by 1983. Presently, no curricula exist in Illinois specifically designed to prepare industrial hygiene technicians to meet this urgent need.

This curriculum planning and resource guide was prepared to serve as a basis for local educators to determine the resources needed to offer industrial hygiene technician curricula and to initiate curriculum development at the local level. The difficulties and expense of developing curricula for a relatively new occupation such as industrial hygiene technician are well documented (Meleen, et. al., 1976; Nelson, 1978; Spetz, et al., 1978; Forgione and Kopp, 1979). This guide is intended to facilitate curriculum development in Illinois by taking full advantage of related curriculum development efforts of institutions across the nation.

Essentially, the curriculum planning and resource guide is a synthesis of curriculum materials currently being used to offer technician training in industrial hygiene. It consists of a description of job duties and competencies, suggested curriculum options, program resource requirements, abstracts of curricular materials and appendices listing further sources of information. Information presented in the guide was obtained from existing technician curricula in industrial hygiene (see Appendix A), which were identified through extensive contracts with State vocational education agencies, professional and trade associations and directories, and local institutions offering industrial hygiene technician curricula. In most instances, representatives of industrial hygiene curricula graciously provided CONSERVA with documentation of available curriculum materials and offered assistance in identifying instructional materials, resource requirements and other useful information. Contacts made with educational publishers and producers of audio-visual instructional materials served to identify and procure textbooks and other learning materials available for providing instruction in industrial hygiene technology.

Suggested procedures for using the curriculum planning and resource guide are presented in the next chapter, which describes a five-step curriculum-development process keyed to the contents of this guide. This is followed by chapters describing industrial hygiene technician job duties, alternative curriculum approaches and program resource requirements. The final chapter presents abstracts of available curriculum and instructional resources.

II. PROCEDURES FOR USE

Presented in this chapter are procedures for using this guide as a resource in the planning, organization and development of a technician curriculum in industrial hygiene. The approach advocates the reliance on existing curricula which have been developed by other institutions. Though it is seldom practical or feasible for an institution to adopt an existing curriculum in its entirety, the work of others does offer a solid foundation upon which to base planning and development activities. The steps outlined below illustrate how the materials presented and referenced in this guide can be utilized in initiating a technician curriculum for industrial hygiene, an occupation which has been determined new and emerging in Illinois, yet one for which there are established curricula in other parts of the country.

The curriculum development process is summarized in Table 1, accompanied by a rationale for each of the procedural steps and references to relevant sections of the resource guide. The procedures elaborated upon below assume experience in curriculum development on the part of the reader. Steps which are well-known to those with such experience are briefly outlined and tied in to relevant information presented in this guide. In those instances where traditional curriculum development procedures are not appropriate due to the newness of the occupation, further elaboration is provided.

Table 1.
Curriculum Planning and Development for New and Emerging Occupations

Step	Purpose	Reference
1. Determine area or regional employment opportunities and extent of student interest	To justify offering the program	Figure 1 Chapter III
2. Establish curriculum advisory committee	To obtain advice on the structure and content of the curriculum and the methodology to be utilized in instruction	Chapter V Appendices B, C
3. Verify, modify, and refine job competencies and/or duties	To align general duties with specific local employment requirements	Chapter III
4. Assess resource requirements	To determine institutional capability to offer the program	Chapter V
5. Develop curriculum	To align resources with job competencies and student interests and qualifications	Chapters IV, V, VI

Step 1. Determine Area or Regional Employment Opportunities and Student Interest

The first step in planning a technician curriculum for industrial hygiene is to determine the demand, in terms of employment opportunities and student interest, for offering training in the occupational area. Five-year projections of regional demand for industrial hygiene technicians have been estimated using data on industrial hygienists and projections produced by the Governor's Office of Manpower and Human Development (Spetz, et al., 1978). These projections, which are portrayed in Figure 1, can serve as a preliminary estimate of employment demand. However, since the estimates are based on secondary sources of regional employment demand, they are subject to local fluctuations. Thus, if the regional estimates indicate a potential need for a technician program in industrial hygiene, a more in-depth investigation of the demand should be undertaken. This will first involve conferring with other postsecondary and/or proprietary schools in the region to determine whether any of those institutions are planning to respond to the need by developing similar curricula. Findings from such conferences could result in the need for joint developmental effort or a determination that only one operating curriculum is necessary to meet the regional demand. In the latter case a joint decision between the institutions and the appropriate State agency as to the most qualified and/or cost efficient institution(s) to offer training should be sought.

The next step is to refine the preliminary demand estimates through a survey of the potential employment community. Job duties and typical employers of industrial hygiene technicians are listed in Chapter III of this report. That information may be used as a basis for the development of survey instrumentation and selection of a sample of employers. It will be necessary to include an industrial hygiene technician job description in the instrumentation. This will ensure that employers are responding to similar positions even if the position is not referred to as industrial hygiene technician. Additionally, employers should be requested to list any discrepancies in the job description as compared to the duties of their industrial hygiene technicians. Contacts made with employers during the survey process should further serve to reveal additional places of employment of industrial hygiene technicians, to identify potential curriculum advisory committee members and/or participants in a cooperative vocational education program, and to stimulate community interest.

The other component of demand which is necessary to estimate prior to curriculum development is student interest in, and qualifications for, the industrial hygiene technician curriculum. This is important for ensuring sufficient enrollment when large expenditures, particularly for equipment purchases and instructional costs, are anticipated. The information on job duties (Chapter III) and typical curriculum and course requirements (Chapter IV) can help to determine potential student interest in enrolling in an industrial hygiene technician curriculum. Summaries of that information can be provided to career information or guidance centers and secondary school guidance counselors in the service area to obtain estimates of potential student interest.

When the necessary information of students' interests is not directly available from the career information centers or guidance counselors, it may be desirable to conduct a survey of potential students. The sample could include students enrolled at the institutions, secondary students enrolled in both public and private institutions, and selected out-of-school populations, such as per-

sons employed in the related field of occupational safety. Again, the information on job duties and curriculum and course requirements contained in Chapters III and IV can be summarized in the survey instrument. The results of the survey will not only provide information on student demand but also indicate the types of students the curriculum is most likely to attract—information that later will be useful in designing a curriculum. If the decision is made to offer the curriculum, these potential industrial hygiene technician students should be made aware of its availability.

Figure 1. 1979-1983 Regional Employment Requirements for Industrial Hygiene Technologist (Statewide Total = 508-1270)

Step 2. Establish Curriculum Advisory Committee

The second stage of the development process, provided that sufficient demand exists for the curriculum, is to establish a curriculum advisory committee. Since the committee will be heavily involved in subsequent steps in the curriculum development process, it is imperative that in the selection of members adequate consideration be given to individuals' qualifications in light of the responsibilities of the committee. Potential members of an industrial hygiene technician curriculum advisory committee are presented in Chapter V. Additionally, the institution may wish to include outside consultants on the advisory committee if insufficient local expertise exists. Since industrial hygiene is a relatively new field it may be essential to solicit external, up-to-date information. This may be obtained from relevant agencies and organizations, in addition to consultants. Lists of potential consultants for developing an industrial hygiene technician curriculum and relevant groups are presented in Appendices B and C, respectively.

At the first meeting of the advisory committee, it is suggested that procedures for the operation of the committee, extent of authority, principal objectives and time schedules be established. Subsequent responsibilities of the committee will be to ensure that the curriculum is consistent with employer requirements and to facilitate placement of students.

Step 3. Verify, Modify and Refine Occupational Competencies and/or Duties

The derivation of job competencies can be a time-consuming and difficult task, particularly for new and emerging occupations. An alternative is to verify and refine existing competencies and/or task listings. A 60-page listing of occupational competencies and tasks of the industrial hygiene technician, which supplement job duties described in Chapter III, is contained in a curriculum guide developed by Vernon, et al., and available from the National Institute of Occupational Safety and Health.* These should be reviewed and refined to reflect unique and general employment requirements of the institution's service area. Input from the curriculum advisory committee and/or employers surveyed in Step 1 will facilitate the accomplishment of this process.

Employer input may be obtained concurrently with the survey conducted in Step 1 by appending a list of tasks or competencies to the survey questionnaire. Employers are requested to rate tasks, manipulative and communication skills, and technical knowledges as to their relevance to the occupation. For example, a five-point rating scale could be applied to a list of skills.[1]

5 - The skill is essential
4 - The skill is very important
3 - The skill is desirable
2 - The skill is not important
1 - The skill is not applicable

A similar scale could be applied to the rating of tasks and technical knowledges. Employers should also be given the opportunity to add to or modify the presented skills, tasks and technical knowledges. Based on the employer ratings and similar input from curriculum advisory committee members, job competencies can be refined to reflect the needs of the service area. These refined competencies should then be used in defining segments of an industrial hygiene technician curriculum.

Step 4. Assess Resource Requirements

In order to determine the capability of an educational institution to offer the curriculum, it is necessary to assess the capabilities of the instructional staff, facilities and equipment available to provide students with the needed manipulative skills, technical knowledge and communication skills. The available resources will have a definite impact on the structure of the curriculum developed in the next step. For example, if equipment necessary for teaching laboratory skills is not available, a cooperative program may be considered.

*An abstract of this document is provided in Chapter VI.

[1]From Johnson County (Kansas) Community College, Office of Institutional Research. "Employer Manpower Needs and Job Entry Requirements for Biomedical Equipment Technician."

The types of equipment, facilities and instructors necessary for implementing an industrial hygiene technician curriculum are presented in Chapter V. With the assistance of the curriculum advisory committee, suggested resources should be evaluated in light of the refinements in job competencies made in Step 3. Additions or changes to resource requirements may be necessary to align them with unique area or regional employment requirements. The resources of the institution should then be assessed as to whether they are adequate to meet the requirements of the curriculum. Where resources are lacking, outside assistance can be solicited; e.g., equipment contributions from manufacturing firms, supplementary guest lectures, equipment demonstrations by suppliers or field trips. Cooperative arrangements with industrial hygiene technician employers, consisting of on-site learning opportunities for students, could also serve to lessen the burdens of expenditures for equipment and instructional resources.

Step 5. Develop Curriculum

At this point, it will be appropriate to determine the curriculum objectives and course progression, instructional materials, and methods and modes of instruction to be used in teaching students the necessary competencies to function as industrial hygiene technicians. Curriculum advisory committee input is most important during this phase of the curriculum planning process. Suggested industrial hygiene technician curriculum options, which are based on curricula currently in use in institutions across the nation, are presented in Chapter IV. Dependent on institutional resources, area or regional competency requirements, and anticipated student interests and qualifications, one or a combination of the curriculum options may be selected. Curriculum and coursework content may then be modified or expanded to address curriculum objectives and unique service area and institutional requirements. Other curriculum guides and materials obtained from existing programs are abstracted in Chapter VI. These guides and materials may be of further use in determining the appropriate curriculum and will be available for local review from the East Central Curriculum Coordination Center in Springfield.

Once the curriculum has been outlined and course objectives established, appropriate instructional materials for achieving the objectives will need to be identified. This process can be facilitated by reviewing the abstracts of instructional materials presented in Chapter VI. The abstracts should be reviewed with the following considerations in mind:

- Relationship of the material to course objectives
- Consistency of the material with mode and methods of instruction
- Compatability of the material with students' anticipated levels of achievement
- Effectiveness of the material in presenting information
- Cost-effectiveness of the material

Selection of materials for instruction should of course be preceded by a critical review of the actual documents, audio-visual, materials, etc.; however, alternatives may be narrowed down by examining abstracts contained in Chapter VI. A majority of the materials abstracted have been procured and will be made available by DAVTE to local educators for further review, preview and assessment of learning possibilities.

The steps outlined in the foregoing discussion represent an approach to curriculum development that relies heavily on the developmental efforts of others. However, it is not suggested that an existing curriculum be adopted in whole without giving due consideration to the transferability of such components as regional employer requirements, student needs, and resource and institutional requirements. The value of a curriculum advisory committee in addressing these considerations has been stressed throughout the curriculum development process. If the recommended steps are taken in the planning and development of the curriculum, the guide may serve to eliminate duplication of effort and as such can represent a cost-effective approach to curriculum development.

III. JOB DESCRIPTION

This chapter describes the job duties and typical employers of industrial hygiene technicians. The information is intended for use during two steps of the curriculum planning process. First, it can serve as a guide when contacting employers and students to determine employment opportunities for industrial hygiene technicians and student interest in enrolling in an industrial hygiene technician curriculum. Secondly, the general information on job duties and the specific competencies presented in Appendix D can be reviewed, modified and refined by employers and advisory committee members so as to ensure that the curriculum will be responsive to the specific industrial hygiene technician occupational skills needed in the service area.

The industrial hygiene technician assists the industrial hygienist in measuring, evaluating and controlling the work environment for the purpose of protecting worker and community health. The technician studies work processes, focusing on such areas as work procedures, materials, machinery, products, by-products and the environment, both inside and outside the plant. The technician selects the site, methods and equipment to be used in measuring physical, chemical and biological stresses in these areas such as noise level, heat, radiation, air contaminants and fungi. After obtaining stress measurements either through direct reading of instruments or laboratory analysis of collected samples, the technician evaluates the results to determine the stress potential for impairing worker health or inflicting community damage. Based on the evaluation the technician may make recommendations for control procedures and equipment to reduce or eliminate the hazard. Industrial hygiene technicians conduct employee education programs for the purpose of preventing occupational disease, and may suggest to management plant rules or standards to promote the healthful conduct or work. Calibration of test equipment (e.g., Podile meter, cyclone separator or gas chromatograph) is another duty technicians perform. In some instances, particularly in large corporations employing several technicians, it is possible for individuals to specialize in areas such as stress measurement, laboratory analysis or equipment calibration.

The skills of a full-time industrial hygiene technician are most likely to be needed by the larger industrial corporations and large insurance companies. In smaller companies, the job duties of an industrial hygiene technician sometime include those usually performed by a safety technician. Conducting first-aid training for employees, maintaining records on individual employee injuries and developing specifications for the purchase or installation of fire protection equipment are examples of common hygiene/safety activities. Even when employed full-time as an industrial hygiene technician, there is considerable similarity to the duties performed by safety technicians. In a recent study conducted for the National Institute for Occupational Safety and Health (Vernon, et al.), 31 percent of the tasks/activities performed by either the industrial hygiene technician or the safety technician were found to be performed by both types of technicians.

The State of Illinois does not require certification of industrial hygiene technicians. However, the American Board of Industrial Hygiene offers certification to persons who would like to document their technological expertise. Certification requirements include adequate performance on a written examination and:

1. A high school diploma plus five years of work experience under the supervision of a professional industrial hygienist; or
2. An Associate Degree in engineering, industrial hygiene, or environmental sciences plus three years or work experience under the supervision of a professional industrial hygienist.

In recognition of the similar responsibilities in many cases of industrial hygiene technicians and safety technicians, the American Board of Industrial Hygiene and the Board of Certified Safety Professionals have appointed a joint committee to study the concept of a certification program for individuals who function at a level in the general area of occupational safety and health. After determining the tasks, activities and other aspects of a paraprofessional position, it is probable that the information will be utilized in the development of certification standards. These standards may be useful in curricula development and other educational/training activities for this position. The expected completion date of this project is late 1979.

IV. CURRICULUM APPROACHES

This chapter provides information on the structure of industrial hygiene technician curricula and the content of specific courses designed to provide students with the various skills and technicial knowledges necessary for employment as industrial hygiene technicians. The curriculum structure and content reflect alternative approaches for industrial hygiene technician preparation. Each alternative is presented for consideration in light of institutional resources and service area needs; they are intended to serve as a framework which can guide in developing industrial hygiene technician curricula within Illinois.

The most widely used approach for preparing industrial hygiene technicians for employment at the entry level is a two-year associate degree curriculum. In addition to the curriculum which grants an associate degree, many community colleges also offer curricula of shorter length and less content emphasis but which grant graduates a certificate.

A fundamental question confronting education institutions desiring to prepare industrial hygiene technicians at either level is whether to offer a general occupational safety and health curriculum which incorporates or allows emphasis in industrial hygiene, or to offer a curriculum focused more exclusively on industrial hygiene alone; i.e., omitting the safety aspect. The answer to this question will be based heavily on the needs of the employing industries in the area and the needs and interests of students. The experience and findings of others who have faced or studied this same question should also be considered.

As noted earlier, Vernon, et al., in a national study to develop curricula for occupational safety and health personnel, found considerable duplication in the responsibilities and duties of safety and hygiene technicians. This finding was a major factor in their decision to develop at the associate degree level a combined curriculum, rather than a separate curriculum for each classification of technician.

The National Institute of Occupational Safety and Health recently completed a national survey of institutions offering occupational safety and hygiene curricula (Weiss, et al., 1979). The curricula were divided into classifications including occupational safety and health/industrial hygiene, occupational safety, and industrial hygiene. At the associate and certificate degree levels, 30 programs were classified as occupational safety and health/industrial hygiene, 14 as occupational safety and only 2 as industrial hygiene. These results strongly indicate the viability of a general approach for training industrial hygiene technicians.

This study of existing curricula which currently function in the preparation of industrial hygiene technicians, and the suggested curriculum format for the preparation of technicians at several levels of employment entry have disclosed discrete and necessary curriculum characteristics. Whether the preparatory curricula be two years in duration or as short as one year, emphasis must be supplied to the enrollees in areas of manipulative skills, technical knowledge and communication skills. The nature of the work done by an industrial hygiene technician and the frequent contacts made with the public, specialized industries and regulatory agencies require that skills with pertinent testing and measuring equipment, technical knowledge on a broad basis, and all facets of communications skills be components of a curriculum in industrial hygiene technology.

The discussions in the succeeding sections illustrate and amplify the foregoing principles of curriculum.

Associate Degree Program

Past developmental studies of occupational safety and health technician curricula (Anderson, 1972; Vernon, et al.) and the current practices of community colleges in the safety and health areas suggest the appropriateness of an industrial hygiene technician curriculum which includes both hygiene and safety. This approach appears to be consistent with responsibility assignment patterns in industry. Further, this approach would provide students with a broader base of knowledge and skills, effectively increasing their employment flexibility. Thus, the following course outline and descriptions describe a curriculum which could accurately be labeled occupational safety and health with an emphasis in industrial hygiene. The curriculum is based on an analysis of the curricula of community colleges from across the nation, and the results of two curriculum development studies (Anderson; and Vernon, et al.). While it stresses the health dimension of industrial environmental management, many of the courses would be useful to students desiring to specialize in safety. With the addition of several courses such as Motor Fleet Safety, System Safety Analysis, Accident Investigation, Loss Control and Human Factors in Safety, a student would be able to cooperatively design with his/her advisor a plan of study emphasizing either hygiene or safety, while acquiring required employment competencies at the entry level in both areas.

Courses	Semester Credit Hours
Introduction to Occupational Safety and Health	3
Recognition, Evaluation and Control of Physical Hazards	3
Industrial Processes	3
Industrial Fire Hazards	3
Industrial Toxicology	3
Control of Physical Exposures	3
Control of Airborne Contaminants	3
Safety and Health Standards	3
Occupational Safety and Health Training Programs	3
Chemistry I	4
Chemistry II	4
Physics I	4
Physics II	4
Technical Mathematics	3
Human Anatomy and Physiology	4
Technical Writing	3
Health and Physical Education	3
English I	3
Speech	3
Human Relations	3
Elective (in the field of communication skills)	3
TOTAL HOURS	68

Introduction to Occupational Safety and Health. This course provides students with an overview of occupational safety and health. The history of the field is reviewed. Current social and legislative requirements, standards, codes and regulations are covered. Various hazards and exposures are described, along with procedures for recognizing, evaluating, controlling and recording these stresses. Occupational injuries and illnesses are described. Students study practices in loss prevention. The course outlines

techniques for conducting worker-safety and health-training programs. Types of casualty insurance, including worker's compensation, are reviewed. Members of the occupational safety and health team are described in terms of their responsibilities and duties. Safety and health professional organizations are delineated in terms of membership characteristics, and services and information provided.

Recognition, Evaluation and Control of Physical Hazards. This course is concerned with eliminating physical hazards to workers commonly found in industry. Methods for identifying mechanical, materials-handling and electrical hazards are given. Controls, engineering safeguards and personal protective equipment are discussed. The role of human factors in safety is described. Approved materials storage practices are presented. presented.

Industrial Processes. Students are provided in this course with an occupational safety and health perspective with which to view industrial processes. Basic industrial processes are described in terms of operations, materials, equipment, worker involvement, products and associated potential hazards. Procedures for the establishment of safety and health controls and criteria are given. Use of process analysis as a tool for comprehensive safety and health program management is taught. Field trips to area industries are conducted to impart to students a clearer understanding of the nature of industrial work.

Industrial Fire Hazards. This course emphasizes the recognition, evaluation and control of fire hazards in industry. Fire loss is described in human and economic terms. The nature and characteristics of flammable materials are discussed. Fire protection laws and codes are presented. Inspection procedures and fire protection systems are described. Also included are methods and equipment used to control fires.

Industrial Toxicology. This course prepares students to recognize and control toxic substances commonly found in industrial settings. The major systems of the human body are described in terms of their functions. Routes by which toxic substances may enter the body are given. The course covers the physical and biological attributes of various toxic substances, and the physiological effects of overexposure. Procedures for the development of threshold limit values are given. Medical procedures for determining worker exposure are described. The student learns proper procedures for the handling and control of toxic substances. Sources of toxicological information are provided.

Control of Physical Exposures. This course provides students with the fundamentals of recognizing, evaluating and controlling physical exposures which could adversely affect worker health. The types of exposures covered include sound, radiation, heat, cold, pressure, light and vibration. These stresses are described in terms of their physics, effects on humans, measurement equipment and techniques, control methods, protective equipment and standards. The principals of audiometry are presented, along with elements of hearing-conservation programs. Laboratory exercises teach students how to use and calibrate measurement instruments.

Control of Airborne Contaminants. This course focuses on monitoring and controlling airborne contaminants. Properties of air and airborne contaminants such as vapors, gases, fumes and aerosols are covered. The physiological effects of excessive exposure are described. Factors to consider in performing air sampling are given. Types of air sampling are presented, along with general principles of operating sampling instruments, and procedures for use of specific kinds of instruments. Measures for controlling airborne contaminants are given. Students learn how to operate and calibrate sampling instruments in the laboratory.

Safety and Health Standards. This course covers the legal standards concerning occupational safety and health to be maintained in the work place. The history of codes and standards is reviewed. State and Federal standards, codes and regulations are presented, with particular attention given to the Occupational Safety and Health Act and its requirements. The course emphasizes application of OSHA standards in typical work situations.

Occupational Safety and Health Training Programs. This course teaches students how to design and conduct safety and health training programs for industry workers. Methods for assessing training needs and establishing training program goals and objectives are presented. Factors to be considered in selecting the mode of presentation (lecture, simulation, discussion, demonstration, etc.) and the length and frequency of presentations are covered. Methods for evaluating trainee learning and program effectiveness are outlined. Techniques for promoting program attendance and maintaining post-program interest in safety and hygiene are given.

Chemistry I. Students are introduced to the fundamental principles, theories and laws of chemistry. Topics include atomic theory, structure of the atom, kinetic-molecular theory, molecular structure, chemical bonding, stoichiometry and periodicity, solutions and colloids, and gas laws. Laboratory work includes measurement of physical properties, gravimetric and titrimetric analysis, chromatography and chromatographic analysis, qualitative analysis, spectroscopy and spectophotometric analysis and sampling. Students learn to use balances, pipettes, burettes, graduated cylinders, thermometers, barometers and spectophotometers.

Chemistry II. This course is a continuation of Chemistry I and includes the study of thermochemistry, solid and liquid states of water, kinetics, the basics of organic and nuclear chemistry, and elements and their compounds. In the laboratory students learn to use pH meters, polarimeters, refractometers, gas chromatographs, infrared spectrometers, UV-VIS spectrophotometers, and atomic absorption spectrometers. Laboratory experiments concentrate on qualitative and quantitative application of these instruments.

Physics I. This course provides students with the fundamental concepts of matter and physics. Topics include mechanics, heat and wave motion, and rotation and vibration. Laboratory exercises enhance the student's understanding of the principles in these areas.

Physics II. This course is a continuation of Physics I. It includes such topics as sound, light, magnetism, electricity and applications of modern physics. Laboratory work increases the student's technical knowledge in these areas.

Technical Mathematics. This course is designed for technology students who will be working in industry. The course includes fundamental algebraic operations, linear equations, functions and graphs, solution of trigonometric functions of right triangles, two-dimensional vectors, law of signs and cosigns, imaginary and complex numbers, systems of linear equations, ratios, proportions and variation, graphs and properties of logarithms, measurement (metric and English), and introduction to parametric statistics.

Human Anatomy and Physiology. Lectures and laboratory exercises present the basic principles of human anatomy and physiology. Topics include the cell; tissues; and skeletal, muscular and nervous systems. The functions and interdependen-

cies of bodily systems such as the circulatory, respiratory, digestive, urinary, endocrine, and reproductive systems are presented.

Certificate Program

The certificate curriculum described below is similar to the associate degree curriculum in that it prepares a student with entry level skills and knowledge for working primarily in the health area while providing limited capabilities in safety as well. The courses are a subset of those contained in the associate degree curriculum. Generally, the occupational safety and health courses have been retained at the exclusion of technical related and general education courses. This type of curriculum will appeal particularly to those who have completed a two- or four-year curriculum in a related field and who desire technical expertise in occupational safety and health. It will also be attractive to employed personnel in the area of health and safety who (a) have been assigned industrial safety and health responsibilities, (b) have little or no background in the area, (c) have limited time for coursework, and (d) desire formal instruction in the field. In a very practical sense, the provision of instruction for employed personnel recognizes the interests and needs of individuals to prepare for higher level jobs and assignments.

Courses	Semester Credit Hours
Introduction to Occupational Safety and Health	3
Recognition, Evaluation and Control of Physical Hazards	3
Industrial Processes	3
Industrial Fire Hazards	3
Industrial Toxicology	3
Control of Physical Exposures	3
Control of Airborne Contaminants	3
Safety and Health Standards	3
Chemistry I	4
Technical Mathematics	3
Technical Writing	3
English I	3
TOTAL HOURS	37

Discussion

Educational institutions on either the secondary or post-secondary levels may function in the preparation of industrial hygiene technicians, depending upon the respective interests, ages and expected job entry competencies of the enrollees.

Since the actual laboratory requirements for a certificate-granting, one-year curriculum can be provided by many area vocational education institutions and comprehensive high schools, it is possible to locate and conduct certificate level curricula at such schools. The curriculum could be offered (a) on a 13th year basis for high school graduates; (b) for young adults on a late afternoon (3-6 p.m.) basis; or (c) for individuals currently employed in the health or safety areas, on an evening basis (7-10 p.m.).

The two-year curriculum leading to the associate degree may be conducted in most technical institutes and community colleges. Such institutions may also choose to conduct the one-year, certificate-granting curriculum or even a series of courses to meet the special requirements of certain enrollees.

Another procedure which deserves serious consideration is that of conducting either associate degree or certificate-granting curricula (or both) on a cooperative basis between secondary and/or post-secondary institutions on the one hand, and industries on the other. Such an arrangement enables the school part of the cooperative arrangement to offer classroom instruction in subject areas described in this document, without the expense of having to purchase equipment and maintain laboratories. Some additional expense must be anticipated, however, with the employment of an industrial coordinator whose role would be to monitor and supervise regularly the kinds and quality of manipulative skills and technical knowledge that cooperating industries provide the enrollees in the industrial hygiene technician curriculum. In the discharge of its part of the cooperative arrangement, the cooperating industries would be required to provide enrollees with on-the-job instruction by a skilled industrial hygiene technician, by an industrial hygienist or by some other qualified individual in the industrial plant. The instruction provided would be in the areas of manipulative skills, technical knowledge associated with the skills and, to some extent, technical report writing.

Involvement of many industries in the area would have the additional advantage of generating wide area support for the curricula offered, and tend toward facilitating the transition of the enrollees in the curriculum from preparation to full-time employment.

V. RESOURCE REQUIREMENTS

Presented in this chapter are the resources required to implement a technician program in industrial hygiene. The first section outlines the composition of a curriculum advisory committee, which is an essential component of curriculum development and maintenance. This is followed by discussions of the facilities and equipment and instructor resources needed to implement a program. These two sections will be useful in (1) determining whether an institution possesses the resources essential to the establishment of an industrial hygiene technician curriculum and (2) planning for the acquisition of needed resources.

Curriculum Advisory Committee

Though a curriculum advisory committee performs almost entirely in an advisory capacity, its input to program development and maintenance is often critical. As noted in Chapter II, the advisory committee participates in most of the curriculum development process. Once a curriculum is established the committee continues to provide support by assisting in cooperative arrangements and job placement, reporting developments in the field which require curriculum modifications and equipment acquisitions, evaluating the performance of graduates and recommending curriculum modifications based on the evaluation, and serving as a link between the school and the community.

The advisory committee for an occupational safety and health curriculum should be comprised of professional personnel currently employed in the field of occupational safety and industrial hygiene and personnel drawn from related endeavors. The first category of individuals may be drawn from private industries, such as steel mills, petro-chemical and chemical manufacturers, assembly plants, and consultant laboratories. Representing the second category of advisory committee members would be owners and managers of these companies. In the public domain, the Illinois Environmental Protection Agency and the U.S. Occupational Safety and Health Administration employ professional personnel concerned with monitoring environmental hazards; such agency representation should also be seriously considered for advisory committee membership. University faculty in the field may also offer valuable advice in matters such as curriculum development and presentation; such advice may be particularly useful in designing a curriculum for which transfer credit would be given by four-year institutions. Finally, when the appropriate occasion presents itself, graduates of the curriculum represent a valuable source of information to an advisory committee. One or two such graduates should be considered for committee membership, along with one or two currently employed industrial hygiene technicians.

Facilities and Equipment

While an occupational safety and health curriculum imposes no unusual physical plant (classroom, laboratory, learning resource center) requirements upon a community college or vocational education institution, the curriculum does require an extensive assembly of equipment. Typical laboratory equipment includes such technical measuring devices as the level meter, velometer, combustible gas detector, geiger counter, gravimetric dust sampler, light meter, oxygen indicator and infra-red spectrometer. A more complete enumeration of the required equipment is contained in Appendix D. That appendix shows the equipment needs of an occupational health and safety curriculum laboratory as described by two curriculum developers and three community colleges. The cost of the equipment on the two lists for which it is shown varies widely from $6,642 (based on 1972 prices) to $111,000 (1976 prices). It may be possible for a community college to defray part of the equipment expenses by working cooperatively with the eventual employing industries in the region to the end that they donate items of current equipment to the school, or (if they prefer) to make a contribution toward the purchase of new equipment. Advisory committees are extremely valuable in offering advice and assistance in relation to equipment needs. Certainly, the committee will be a valuable resource in establishing the priority of equipment to be purchased, should insufficient funds be available to completely equip a modern laboratory. Before any purchases are made, federal standards for sampling equipment should be reviewed.

Instructor Qualifications

The teaching staff of the industrial hygiene courses in an occupational safety and health curriculum should be comprised of instructors with acceptable technical and practical work backgrounds in industrial hygiene. The most pertinent qualifications would be a baccalaureate or master's degree in the field and work experience in recognizing, evaluating and controlling environmental stresses which may have adverse effects on the health of workers or the general public. Applicable work experience and an undergraduate degree or graduate degree in related fields such as chemistry, physics and environmental or public health also can be acceptable preparation for the instructional staff. Community colleges may be able to supplement their full-time instructional staff with professional industrial hygienists drawn from the private or public sector on a part-time basis. Further, the staff of the industrial hygiene curriculum should be complemented by instructors with a background in safety, who have gained their respective technical knowledge in educational fields such as occupational safety, environmental engineering and industrial engineering.

VI. ABSTRACTS OF CURRICULUM MATERIALS

This chapter contains abstracts of curriculum and instructional material that were identified during the process of procuring curriculum information from industrial hygiene technician programs nationwide. Two types of curriculum resources—curriculum guides for the field and a digest of educational programs—are presented initially. These can be used as supplements to this guide in planning and developing an industrial hygiene technician curriculum.

Abstracts of instructional and learning materials follow. These texts and references provide a good foundation for industrial hygiene technician coursework. An additional source of learning materials is local equipment manufacturers or distributors. Equipment manuals are frequently used as instructional resources, and their availability should be investigated during equipment procurement. Other supplementary resources are journals or periodicals and standards. A list of relevant journals and periodicals is presented in Appendix E.

While the instructional materials presented in this guide provide a good foundation in terms of available instructional materials, the reader is advised to keep informed of new developments in the rapidly-changing field. Reading current literature (e.g., journals and newsletters) is one means of keeping informed. Additionally, by maintaining close contact with curriculum advisory committee members and employers of industrial hygiene technicians, instructors will be able to adapt their programs of instruction to keep in step with technological innovations.

Title: INDUSTRIAL HYGIENE TECHNOLOGY: SUPPLEMENTARY CURRICULUM MATERIALS
Compiled By: CONSERVA, Inc.
Available From: East Central Curriculum Coordination Center
100 North 1st Street
Springfield, IL 62777
Year: 1979

This document was compiled and bound by CONSERVA, Inc. and consists of curriculum outlines, course descriptions and course objectives used in various post-secondary vocational education programs across the country. The following is a list of community colleges, universities and technical institutes represented in the document:

- Catonsville Community College
- Delgado College
- Ferris State College
- Housatonic Community College
- Hudson Valley Community College
- Northern Virginia Community College
- San Diego City College

CURRICULUM GUIDE

Title: CURRICULUM GUIDE FOR OCCUPATIONAL SAFETY AND HEALTH TECHNICIANS
Author: Gilbert L. Rhodes and Associates
Publisher: Chancellor's Office
California Community Colleges
Sacramento, CA 95814
Date: 1972
No. of Pages: 259
Cost: $5.50

This publication reports the results of a study to determine the needs for occupational safety and health technicians in California and the scope of training that would be required. The study found that there was an immediate need for additional technicians in all metropolitan areas surveyed and each of the various sectors of the economy in the State. A model curriculum was developed for training occupational safety and health personnel at the certificate and the associate degree levels. This guide contains the suggested curricula and related course descriptions. Each occupational safety and health course is described in terms of a catalog description, course objectives, suggested time schedule and sequence of instruction, and recommended text. Additionally, weekly lessons plans are given for each course which identify the objectives for the week, a lecture outline, and instructor references. A bibliography of occupational safety and health materials which, at that time, could be used as the basis for a reference library is presented.

CURRICULUM GUIDE

Title. A SUGGESTED CURRICULUM FOR THE OCCUPATIONAL SAFETY AND HEALTH TECHNICIAN
Authors: Ralph J. Vernon, Bruce B. Byers, Richard B. Konzen and Jerry R. Duncan
Publisher: National Institute of Occupational Safety and Health
Division of Training
Cincinnati, OH 45226
Date: Undated
No. of Pages: 199
Cost: Available at no cost on a limited basis

This report is seventh in a series of reports to be completed under NIOSH-CDC CONTRACT 99-74-94: *Development and Validation of Career Development Guidelines by Task/Activity Analysis of Occupational Safety and Health Professions.* In this report, a suggested occupational health and safety curriculum leading to an associate degree is presented. In addition, certificate programs for the occupational health technician and the occupational safety technician are also given. For each of the courses included in the curriculum, a course outline is presented. For those courses directly related to occupational safety and health, the following components are included:

- Course title and reference number
- Semester hours, credit hours and total hours
- Prerequisites
- Brief descriptions of the course
- References
- Equipment
- Related tasks
- Performance objectives
- Topic outline.

(Excerpts taken from authors' Abstract)

CURRICULUM GUIDE

Title: DIRECTORY OF ACADEMIC PROGRAMS IN OCCUPATIONAL SAFETY AND HEALTH
Authors: William J. Weiss, III, Thomas C. Purcell, Mathew H. Street, and Peter A. Kendrick
Publisher: National Institute for Occupational Safety and Health
Division of Training and Manpower Development
Cincinnati, OH 45226
Date: 1979
No. of Pages: 116
Cost: Free

This directory lists occupational safety and health programs identified in two national surveys (1977, 1979). The programs described are divided into five major categories: occupational safety and health/industrial hygiene, occupational safety, industrial hygiene, occupational health nursing and occupational medicine. Within each category, the programs are grouped by degree level (associate degree and certificate or baccalaureate and advanced degree). The types of information provided for each program include: name of institution, institutional division containing

program, address. contact person, telephone number, degree(s) offered, courses in program and tuition rate.
PROGRAM DIGEST

Title:	ACCIDENT PREVENTION MANUAL FOR INDUSTRIAL OPERATIONS
Author:	National Safety Council
Publisher:	National Safety Council 444 N. Michigan Avenue Chicago, IL 60611
Date:	1974
No. of Pages:	1,523
Cost:	$40.00

This book is a comprehensive treatment of the field of occupational safety. The material is presented in 45 chapters. Chapter 1 traces the history and growth of occupational safety. Chapter 2 discusses the Occupational Safety and Health Act of 1970. Organization of a safety program is the subject of Chapter 3. Chapter 4 presents inspection and control procedures for reducing accidents, while Chapter 5 discusses removing hazards from the job. Chapter 6 discusses accident records and injury rates. Accident investigation, analysis and costs are discussed in Chapter 7. Chapter 8 is concerned with Worker's Compensation Insurance. Chapter 9 focuses on safety training. Human factors engineering is the focal point of Chapter 10. Human behavior and safety is discussed in Chapter 11. Chapters 12 and 13 discuss maintaining interest in and publicizing safety, respectively. Chapter 14 describes the use of audiovisual media in promoting safety. Chapter 15 is concerned with office safety. Industrial buildings and plant layout are discussed in Chapter 16, while Chapter 17 presents information on building construction and maintenance. Chapter 18 gives procedures for emergency planning. Chapter 19 describes personal protective equipment. Chapter 20 discusses industrial sanitation and personal facilities. Occupational Health Services are described in Chapter 21. The focal point of Chapter 22 is non-employee accident prevention. Sources of information and assistance in the establishment and operation of a safety program are presented in Chapter 23. Chapters 24 through 36 discuss specific safety aspects of a variety of industrial equipment and procedures, including materials handling and storage; hoisting apparatus and conveyors; ropes, chains and slings; power industrial trucks; elevators and plant railways; point-of-operation and transmission guards; woodworking machinery; machine tools; coal forming of metals; hot working of metals; welding and cutting; hand and portable power tools; and exhaust and ventilation. Chapter 37 contains basic information regarding the recognition, evaluation and control of occupational health problems. Chapter 38 discusses industrial toxicology, while Chapter 39 focuses on chemical hazards. Chapter 40 is concerned with noise and hearing conservation. Electrical hazards, and flammable and combustible liquids are the subjects of Chapters 41 and 42, respectively; Chapter 43 discusses fire protection. Boilers and unfired pressure vessels are discussed in Chapter 44. Safety factors relating to motorized equipment are presented in Chapter 45. Chapter 46 contains safety engineering tables.
TEXT OR REFERENCE

Title:	AIR POLLUTION MANUAL, PART I: EVALUATION
Editor:	Paul M. Giever
Publisher:	American Industrial Hygiene Association 66 S. Miller Road Akron, OH 44313
Date:	1972
No. of Pages:	259
Cost:	$15.00

This book is concerned with the effects of air pollution on humans, animals, plants, property and economics. Also discussed are the sampling, analysis,and meteorological aspects of air pollution. The book contains 13 chapters. Chapter 1 discusses legislative trends and administrative procedures regarding air pollution. Chapter 2 is concerned with industrial/community relations. Chapter 3 describes the sources of air pollution. The effects of air pollution on the health of humans and animals are described in Chapters 4 and 5, respectively. Chapter 6 describes the effects of air pollution on vegetation, while Chapter 7 focuses on property and economical effects. Chapter 8 provides procedures for conducting community air pollution surveys. Instruments and methods for sampling ambient air are given in Chapter 9. Chapter 10 is concerned with source sampling. Chapters 11, 12, and 13 discuss chemical analysis, meterology and ambient air quality, respectively.
TEXT OR REFERENCE

Title:	AIR POLLUTION MANUAL PART II: CONTROL EQUIPMENT
Editor:	Knowlton J. Caplan
Publisher:	American Industrial Hygiene Association 66 S. Miller Road Akron, OH 44313
Date:	1968
No. of Pages:	150
Cost:	$15.00

This manual is the second in a two-volume set on the subject of air pollution. Volume I covers general aspects of air pollution, including its effects, sampling and administration of control programs. Volume II is concerned solely with the equipment for control of air pollution sources. It is written for the practicing plant or process engineer. In describing control equipment, the authors have attempted to provide enough information so the reader may understand the collection mechanisms utilized, and may select the appropriate type of equipment for the problem at hand. Discussion of the major parameters of performance, it is hoped, will be helpful in evaluation of performance, in maintenance and in trouble shooting, as well as in the original selection of equipment. The information is organized into 13 chapters. Chapter 1 discusses the factors which have led to technical and economic problems in the application of control equipment to industrial air pollution sources. Chapter 2 discusses the properties of aerosols. Process factors affecting equipment selection are described in Chapter 3. Chapters 4-7 discuss specific types of equipment; mechanical collectors, filtration, wet collectors and electrical precipitators, respectively. Chapter 8 is concerned with the factors controlling the effectiveness of physical absorption in dynamic systems, types of absorbents and design parameters of dynamic systems. Chapter 9 focuses on equipment and general design concepts for absorption of gases. Incineration of gases and vapors is the subject of Chapter 10. Chapter 11 describes the principles, design, operating characteristics, applications, efficiency and costs of catalytic combustion. Performance testing is emphasized in Chapter 12. Procedures for the disposal of collected material are given in Chapter 13. A glossary of air pollution terms is provided. (Excerpts taken from editor's Preface)
TEXT OR REFERENCE

Title:	BASIC INDUSTRIAL HYGIENE
Author:	Richard S. Brief
Publisher:	American Industrial Hygiene Association 66 S. Miller Road Akron, OH 44313
Date:	1975
No. of Pages:	245
Cost:	$10.75

This book provides an overview of the field of industrial hygiene. The information is presented in 21 sections. Section 1 discusses the development of industrial hygiene, while Section 2 contains a reference list of scientific periodicals and texts. The general principles of industrial hygiene are given in Section 3. Section 4 contains a review of mathematics. Sections 5 and 6 describe the role of the industrial physician and the industrial toxicologist in industrial hygiene programs, respectively. Procedures for gas and vapor sampling are given in Section 7. Section 8 discusses analytical chemistry. Section 9 focuses on sampling for particulates. Calibrations of air sampling instruments is the subject of Section 10. Sections 11 through 18 discuss aspects of specific types of stress agents, including noise, electromagnetic spectrum, ionizing radiation, ultraviolet, visible light, microwaves, lasers, and heat and cold, respectively. Section 19 is concerned with industrial ventilation. Respiratory protection devi-

ces are described in Section 20. Section 21 contains laboratory exercises, such as calibration of a combustible gas indicator.
TEXT OR REFERENCE

Title:	FIRE PROTECTION HANDBOOK
Editors:	Gordon P. McKinnon and Keith Tower
Publisher:	The National Fire Protection Association 470 Atlantic Avenue Boston, MA 02210
Date:	1976
No. of Pages:	1,224
Cost:	$43.50

This handbook is intended as a single-source reference book on good contemporary fire protection practices. The information is presented in seventeen sections. Section 1 describes the characteristics of fire problems through reference to current data on loss of life and property from fire. Section 2 discusses the characteristics and behavior of fire. Section 3 contains information on the fire hazard properties of materials and hazards associated with their storage, handling and use. Section 4 is devoted to the more commonly encountered industrial equipment and processes and the hazards associated with them. Measures that can be taken to eliminate or reduce hazards are discussed. Information on a variety of miscellaneous fire protection and prevention problems is given in Section 5. Section 6 is concerned with fire hazard aspects of building construction. Section 7 discusses the fire hazards associated with building services. Section 8 discusses fundamentals of human characteristics and behavior that must be considered in providing firesafe environments in buildings, identifies life hazard situations and factors contributing to them in the occupancy in question (e.g., residential and health care), and discusses life safety requirements associated with them. The role of public fire protection is explained in Section 9 in terms of its organizational structure, administrative functions and operational procedures, and the facilities and equipment required in fulfilling its mission. Section 10 describes the responsibilities of the various levels of management in an organization for private fire protection. Water supplies and facilities are the focal points of Section 11. Fire alarm systems, detection devices and guard devices are described in Section 12. Section 13 discusses extinguishing agents. Section 14 focuses on the water sprinkler system. Special fire protection systems such as halogenated extinguishing systems are presented in Section 15. Section 16 provides information on portable fire extinguishers. Section 17 focuses on transportation and fire hazards. Procedures to follow in preparing property inspection reports and plans, as well as a series of useful mathematical and conversion tables and tables on the strength and size of materials are included in Section 18. The six appendices provide information on organizations with fire protection interests, fire testing and research laboratories, the role of the federal government in fire protection, and fire protection standards and laws. (Excerpts from editor's Preface)
TEXT OR REFERENCE

Title:	FUNDAMENTALS OF INDUSTRIAL HYGIENE
Editor:	Julian B. Olishifski
Publisher:	National Safety Council 444 N. Michigan Avenue Chicago, IL 60611
Date:	1979
No. of Pages:	1,277
Cost:	$30.00

This book is intended both as an introductory textbook for students of industrial hygiene and as a reference for manufacturers, labor and public service organizations, and government agencies. Included is basic information needed to recognize, evaluate and cope with the stresses that are the concern of the industrial hygienist. The book is organized into 6 major parts, each of which is meant to stand alone as a reference source. Part I includes chapters on the fundamental aspects of the anatomy, physiology, hazards and pathology of the lungs, skin, ears and eyes. A background is provided which lays the groundwork for understanding how organ systems interrelate and function. Part II of the manual is concerned with the recognition of specific environmental factors or stresses. Basic information is given on the various types of instruments available to measure the stresses and how to use the instruments properly to obtain valid measurements. Part III describes methods and techniques of evaluating hazards. Included in Part III is one of the more important aspects of an industrial hygiene program: the methods used to evaluate the extent of exposure to harmful chemical and physical agents. Part IV deals with the control of environmental hazards. Although industrial hygiene problems vary, the basic principles of health-hazards control, problem-solving techniques and the examples of engineering control measures given here are general enough to have bona fide application. To augment the basics, specific information is covered in the chapters on industrial ventilation. Part V is directed specifically to persons responsible for conducting and organizing industrial hygiene programs. It discusses in detail the roles of the industrial hygienist, the nurse, the safety professional and the physician in the implementation of a successful program. Because occupational health conservation has become a matter of government concern, federal regulations and guidelines for the control of excess exposure to environmental stresses are discussed in this part. Part VI is concerned with sources of help and information. Included are a comprehensive, annotated bibliography and listings of professional and service organizations, standards, governmental agencies, training courses and audiovisuals. The appendices include threshold limit values, information on specific toxic substances, a listing of hazardous chemicals and sources of more information on them, and a glossary of more than 2,000 terms used in industrial hygiene, occupational health, pollution control, and chemical and radiological research and production. (Excerpts taken from editor's Preface).
TEXT OR REFERENCE

Title:	HEATING AND COOLING FOR MAN IN INDUSTRY
Authors:	Multiple
Publisher:	American Industrial Hygiene Association 66 S. Miller Road Akron, OH 44313
Date:	1975
No. of Pages:	147
Cost:	$15.75

This book reviews methods for evaluating and controlling heat and cold stress conditions in the industrial environment. The book is organized into 14 chapters. Chapter 1 discusses the general planning considerations for a temperate industrial environment. Chapter 2 gives heat exchange and human tolerance limits. Chapter 3 contains procedures for the control of radiant heat. Different types of ventilation systems are described in Chapter 4. Chapter 5 discusses the process and methods for heating space, while Chapter 6 gives principles for removing heat from space. Chapter 7 is concerned with moisture control. Chapter 8 focuses on the composition of air, and heat conservation and recovery. Chapter 9 presents information on air distribution. Chapter 10 examines the selection and application of air filters. Equipment and procedures for testing air flow systems are given in Chapter 11. Chapter 12 describes instruments used for the assessment of the thermal environment. Chapter 13 discusses air flow around buildings and building air flow and pressurization. Chapter 14 focuses on the design of supply and exhaust systems.
TEXT OR REFERENCE

Title:	THE INDUSTRIAL ENVIRONMENT—ITS EVALUATION AND CONTROL
Authors:	Multiple
Publisher:	U.S. Government Printing Office Washington, D.C.
Date:	1973
No. of Pages:	719
Cost:	$13.75

This book is a comprehensive text on industrial hygiene, covering subjects from mathematics to medicine. The development of this book was coordinated by the National Institute for Occupational Safety and Health. The authors of individual chapters were selected for their exper-

tise in the particular subject covered. The information is presented in 50 chapters. Chapter 1 describes the history, recent developments, scope, function and needs of industrial hygiene. The significance of the occupational environment as part of the total ecological system is the focal point of Chapter 2. Chapters 3 through 6 review mathematics, chemistry, biochemistry and physiology in relation to industral hygiene, respectively. Chapter 7 discusses industrial toxicology. Chapter 8 presents principles in the use of quality standards for the work environment. The significance and uses of guides, codes, regulations and standards for chemical and physical agents are described in Chapter 9. Chapter 10 presents general principles used in evaluating the occupational environment. Chapter 11 describes instruments and techniques used in calibrating sampling equipment. Preparation of known concentrations of air contaminants is the subject of Chapter 12. Chapter 13 discusses sampling air for particulates, while Chapter 14 discusses sizing methodology. Sampling and analysis of gases and vapors are emphasized in Chapter 15. Chapter 16 describes direct reading instruments for determining concentrations of aerosols, gases and vapors. Chapter 17 presents information on the medical aspects of the occupational environment. Separation processes in analytical chemistry are discussed in Chapter 18. Spectrophotometry, emissions, spectroscopy and gas chromatography are the subjects of Chapters 19, 20 and 21, respectively. Chapter 22 discusses quality control for sampling and laboratory analysis. Chapter 23 presents the physics of sound, while Chapter 24 describes the physiology of hearing. Chapter 25 is concerned with noise measurement and acceptability criteria. Chapters 26-30 discuss five specific stress agents: vibration, illumination, non-ionizing radiation, ionizing radiation and heat, respectively. Thermal standards and measurement techniques are presented in Chapter 31. Chapter 32 presents the ergonomic aspects of biomechanics. The influences of industrial contaminants on the respiratory system are discussed in Chapter 33. The recognition, control and prevention of occupational dermatoses are discussed in Chapter 34. Principles of controlling the occupational environment are given in Chapter 35. Chapter 36 describes personal protective devices. Chapter 37 discusses control of noise exposures, while Chapter 38 discusses control of exposures to heat and cold. Principles of ventilation are given in Chapter 39. Chapter 40 describes instruments and techniques used in evaluating the performance of air flow systems. Local exhaust systems and the design of ventilation systems are the focal points of Chapters 41 and 42, respectively. Chapters 43-46 discuss the control of industrial stack emissions, industrial water emissions, industrial solid waste and community noise from industrial sources. Chapter 47 is concerned with safety. Chapter 49 focuses on the design and operation of occupational health programs in general, while Chapter 49 examines these programs in relation to governmental agencies. Chapter 50 outlines the steps required in an industrial hygiene survey.

TEXT OR REFERENCE

Title:	INDUSTRIAL HYGIENE
Authors:	Robert W. Allen, Michael D. Ells, and Andrew W. Hart
Publisher:	Prentice-Hall, Inc. Old Tappan, NJ 07675
Date:	1976
No. of Pages:	363
Cost:	$16.95

This book is an introductory textbook for students in industrial hygiene, and a reference book for manufacturers, public service organizations and government agencies. Included is basic information needed to recognize, evaluate and control the stresses that are of concern to the industrial hygienist. Three distinctive features of the book are its emphasis on information of practical utility, its inclusion of information omitted in other general industrial hygiene books (such as microbiological hazards), and its inclusion of portions of the Occupational Safety and Health Act standards that pertain to industrial stresses and a discussion of those standards. The information is presented in ten chapters. Chapter 1 defines industrial hygiene, traces its history, establishes its importance and describes personnel responsibility for effective programs. Chapter 2 presents policies and procedures of safety training and investigating programs. Chapters 3 through 9 define and present procedures for evaluating and combating air contaminants, non-ionizing radiation, ionizing radiation, light, heat, noise and microbiological hazards. Chapter 10 discusses different types of ventilation, methods for measuring the quantity of air flow and OSHA standards for local ventilation. The appendices present information on pre-employment and follow-up physical examinations, industrial medical facilities, basic principles for treating exposure to hazardous chemicals, portions of the Occupational Safety and Health Act, organizations and agencies concerned with industrial hygiene and, in bibliographical form, some of the more important recent industrial hygiene publications. (Excerpts taken from author's Preface.)

TEXT OR REFERENCE

Title:	INDUSTRIAL NOISE AND HEARING CONSERVATION
Editors:	Julian B. Olishifski and Earl R. Harford
Publisher:	National Safety Council 425 North Michigan Avenue Chicago, IL 60611
No. of Pages:	1,120
Cost:	$28.50

The primary purpose of this book is to provide a reference for persons who have either an interest in or a direct responsibility for the preservation of hearing of those exposed to high levels of industrial noise. Thus, it is intended to be of use to engineers, executives, audiometric technicians, industrial hygienists, nurses, audiologists, physicians and safety personnel. It would also be appropriate as a self-teaching text, as well as a reference for training courses in industrial noise and hearing conservation. The book is organized into six major parts, each of which is meant to stand alone as a reference source. Part I includes chapters on the fundamental aspects of noise problems, and the physical and subjective aspects of sound. A background is provided which lays the groundwork for understanding how sound energy is produced, transmitted and measured. Part II of the manual is concerned with the measurement of sound. Basic information is given on the various types of instruments available to measure sound levels and how to use the instruments properly to obtain valid measurements as well as where and when to take sound measurements. Part III describes the effects of noise on man. The anatomy, physiology and common pathologies of the ear are discussed along with the medical aspects of hearing conservation. Federal regulations and guidelines on noise exposure are discussed in this part, in addition to workers' compensation and medicolegal factors. Also included in Part III are the methods used to evaluate the extent of noise exposure. Part IV deals with the control of noise and noise exposure. The basic principles of noise control, problem-solving techniques and the examples of engineering noise control measures presented are sufficiently general to have wide application. To augment the basics, specific information is covered in vibration measurements and control. Sound level specifications for the purchase of equipment and machinery and personal hearing-protective devices are also discussed. Part V is directed specifically to persons responsible for conducting hearing tests for industrial personnel. Discussed in detail are the fundamental concepts of aid-conduction, pure-tone audiometry, audiometer calibration, and techniques for the determination of a hearing threshold. Manual and automatic audiometry, interpretation of audiograms and an explanation of the testing problems a technician might encounter during an audiometric examination are described. Part VI discusses an effective industrial hearing-conservation program. Included are chapters on the roles of the nurse, the audiologist and the physician in the implementation of a successful program. The final chapter of this book contains a comprehensive, annotated bibliography and listings of professional and service organizations, standards, governmental agencies, training courses and audiovisuals. These appendices provide information from the Federal Occupational Noise Regulations, Federal Environmental Noise Regulations, Intersociety Committee Guidelines for Noise Control; a glossary; and a review of mathematics. (Excerpts from author's Preface.)

TEXT OR REFERENCE

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Title: MOTORFLEET SAFETY MANUAL
Author: National Safety Council
Publisher: National Safety Council
425 N. Michigan Avenue
Chicago, IL 60611
Date: 1972
No. of Pages: 408
Cost: $12.00

This book discusses the establishment and operation of a motorfleet loss prevention program. The book is organized into 20 chapters. Chapter 1 discusses the costs of accidents. Chapter 2 presents the elements of a fleet safety program. The responsibilities and duties of a safety director are discussed in Chapter 3. Chapters 4 and 5 are concerned with the maintenance of accident records on motor vehicles and employees, respectively. Procedures for the selection of drivers are given in Chapter 6. Chapter 7 discusses driver training while Chapter 8 focuses on driver supervision. The roles of alcohol and drugs in driver safety are discussed in Chapter 9. The purpose and organization of an accident review committee are presented in Chapter 10. Chapter 11 discusses the establishment and operation of a safety program. Off-the-job safety is the concern of Chapter 12. The nature of a vehicle safety program is described in Chapter 13. Chapter 14 presents procedures for supervising a scattered fleet. Chapters 15 through 19 discuss specific aspects of operating sales, ulance and school bus fleets, respectively. Chapter 20 is concerned with selling the safety program to employees and others. The 12 appendices contain information on a case history of one minor accident, getting publicity from safe driver awards, safety meetings for commercial drivers, job safety analysis, protective coloring for commercial vehicles, brakes and braking distances, preventive maintenance, skill drills and test courses, carbon monoxide dangers, the Occupational Safety and Health Act, the Bureau of Motor Carrier Safety and sources of information on chemical safety.

TEXT OR REFERENCE

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Weis, William J. and others. *Directory of Academic Programs in Occupational Safety and Health.* Cincinnati, OH: Division of Training and Manpower Development, National Institute for Occupational Safety and Health, 1979.

Vernon, Ralph J. and others. *A Suggested Curriculum for the Occupational Safety and Health Technician.* Cincinnati, OH: Division of Training and Manpower Development, National Institute for Occupational Safety and Health, undated.

APPENDICES

APPENDIX A

SCHOOLS CONTACTED WHICH OFFER COURSEWORK IN INDUSTRIAL HYGIENE

CALIFORNIA
San Diego City College
3375 Camino del Rio South
San Diego, CA 92108

CONNECTICUT
Housatonic Community College
510 Barnum Avenue
Bridgeport, CT 06608

ILLINOIS
University of Illinois at Urbana
Urbana, IL 61801

LOUISIANA
Delgado College
615 City Park Avenue
New Orleans, LA 70119

MARYLAND
Catonsville Community College
800 South Rolling Road
Catonsville, MD 21228

MICHIGAN
Ferris State College
Big Rapids, MI 49301

NEW YORK
Hudson Valley Community College
Vandenburgh Avenue
Troy, NY 12180

VIRGINIA
Northern Virginia Community College
(Alexandria College)
3001 North Beauregard Street
Alexandria, VA 22311

Thomas Nelson Community College
Hampton, VA 23366

WISCONSIN
Western Wisconsin Technical Institute
Sixth and Vine Streets
LaCrosse, WI 54601

APPENDIX B

INDIVIDUALS INDICATING AN INTEREST IN CONSULTING

Mr. George Burgess
Northern Virginia Community College
(Alexandria Campus)
3001 North Beauregard Street
Alexandria, VA 22311
(703) 323-4251

Mr. Richard Cooper
Housatonic Community College
510 Barnum Avenue
Bridgeport, CT 06608
(203) 579-6471

Mr. Walter DeFelice
San Diego City College
3375 Camino del Rio South
San Diego, CA 92108
(714) 280-7610

Mr. John Friel
P.O. Box 9407
Briarfield Station
Hampton, VA 23670
(804) 826-4800

Mr. George Hansberry
Delgado College
615 City Park Avenue
New Orleans, LA 70119
(504) 486-7393

Mr. Paul Lynch
Western Wisconsin Technical Institute
Sixth and Vine Streets
LaCrosse, WI 54601
(608) 785-9178

Mr. Michael Tillotson
Ferris State College
Swan 302 A
Big Rapids, MI 49307
(616) 796-9971

Mr. Frank Valentino
Catonsville Community College
800 South Rolling Road
Catonsville, MD 21228
(301) 455-4247

APPENDIX C
RELATED AGENCIES/ORGANIZATIONS

Air Pollution Control Association
4400 Fifth Avenue
Pittsburgh, PA 15213

American Academy of Industrial Hygiene
475 Wolf Ledges Parkway
Akron, OH 44311

American Academy of Occupational Medicine
801 Old Lancaster Road
Bryn Mawr, PA 19010

American Academy of Ophthalmology and Otolaryngology
15 Second Street, S.W.
Rochester, MN 55901

American Academy of Optometry
117 West Broadway
P.O. Box 565
Owatonna, MN 55060

American Association for the Advancement of Science
1515 Massachusetts Avenue, N.W.
Washington, DC 20005

American Association of Occupational Health Nurses
79 Madison Avenue
New York, NY 10016

American Board of Industrial Hygiene
475 Wolf Ledges Parkway
Akron, OH 44311

American Board of Preventive Medicine
410 West 10th Avenue
Columbus, OH 43210

American Chemical Society
1155 16th Street, N.W.
Washington, DC 20036

American Conference of Governmental Industrial Hygienists
P.O. Box 1937
Cincinnati, OH 45201

American Industrial Hygiene Association
475 Wolf Ledges Parkway
Akron, OH 44311

American Institute of Chemical Engineers
345 47th Street
New York, NY 10017

American Medical Association
535 North Dearborn Street
Chicago, IL 60610

American Occupational Medical Association
150 North Wacker Drive
Chicago, IL 60606

American Optometric Association
7000 Chippewa Street
St. Louis, MO 63119

American Public Health Association
1015 18th Street, N.W.
Washington, DC 20036

American Society for Microbiology
1913 I Street, N.W.
Washington, DC 20006

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

American Society for Training and Development
P.O. Box 5307
Madison, WI 53705

American Society of Heating, Refrigerating and Air Conditioning Engineers
345 East 47th Street
New York, NY 10017

American Society of Safety Engineers
850 Busse Highway
Park Ridge, IL 60068

Board of Certified Safety Professionals
501 South Sixth Street, Suite 101
Champaign, IL 61820

Health Physics Society
P.O. Box 156
Easy Weymouth, MA 02189

Human Factors Society
P.O. Box 1369
Santa Monica, CA 90406

Illuminating Engineering Society of North America
345 East 47th Street
New York, NY 10017

Institute of Electrical and Electronics Engineers
345 East 47th Street
New York, NY 10017

Institute of Environmental Sciences
940 East Northwest Highway
Mount Prospect, IL 60056

Industrial Health Foundation
5321 Centre Avenue
Pittsburgh, PA 15232

National Fire Protection Association
470 Atlantic Avenue
Boston, MA 02210

National Safety Council
425 North Michigan Avenue
Chicago, IL 60611

National Institute for Occupational Safety and Health
Danac Building
5600 Fisher's Lane
Rockville, MD 20852

Occupational Safety and Health Administration
U.S. Department of Labor
14th and Constitution Avenue
Washington, DC 20210

Society of Automotive Engineers
400 Commonwealth Drive
Warrendale, PA 15096

Society of Manufacturing Engineers
20501 Ford Road
Dearborn, MI 48128

Society of Toxicology
475 Wolf Ledges Parkway
Akron, OH 44311

System Safety Society
P.O. Box A
Newport Beach, CA 92663

APPENDIX D
EQUIPMENT LISTS AND INVENTORIES

D.1 Equipment Suggested by Vernon, et al.

D.2 Equipment Suggested by Anderson

D.3 Equipment Inventory of Housatonic Community College

D.4 Equipment Inventory of Northern Virginia Community College

D.5 Anticipated Equipment Requirements of San Diego City College

Appendix D.1

Equipment Suggested by Vernon, et al.*

*The list was obtained from: Vernon, Ralph J., Byers, B.B., Kinzer, R.B., and Duncan, J.R. *A Suggested Curriculum for the Occupational Health and Safety Technician.* Cincinnati, OH: U.S. Department of Health, Education, and Welfare; National Institute for Occupational Safety and Health. Only the equipment corresponding to courses contained in the curriculum suggested in the present guide are listed.

Suggested Equipment

Computer terminal with connection to computer
35 mm camera
Videotape, camera, and related equipment
Normal Chemistry I and II, and Physics laboratory and related equipment
Ammeter
Ohm meter
Volt meter
Thermocouple
Strobe light
Tachometer
Pressure gauge
Temperature gauge
Ground fault indicator
Strain gauge
Combustible gas detector
Sound level meter
Octave band analyzer
Noise dosimeter
Film badge
Geiger counter
Radiation dosimeter
Ionization chamber
Proportional counter
Scintillation counter
Dry bulb thermometer
Wet bulb thermometer
Globe thermometer
Hygrometer
Velometer
Colormetric tubes
Air pump
Halidemeter
Mercury vapor and ester
Elutriator
Cyclone separator
Impinger
Personnel sampler
Combustible gas detector
Cascade impactor
Membrane filter and holder
Electrostatic precipitator
Charcoal tubes
Wet test meter
Dry gas meter
Venturi meter
Rotameter
Spirometer
Velometer
U-tube manometer
35 mm slide projector
Screen
Overhead projector
Flip chart

Appendix D.2

Equipment Suggested by Anderson*

*The list was obtained from: Anderson, William M. *Curriculum Guide for Occupational Safety and Health Technicians.* Sacremento, CA: California Community Colleges, Chancellor's Office, 1972.

Following are estimates of Industrial Hygiene Instrument costs. The instrumentation is based on a 15 student laboratory with standard chemical laboratory facilities. The ideal goal would be one instrument for every two students; however, this is a very costly approach. The cost approach presented here is to provide at least one representative instrument for each category of instruments with duplication suggested for the less costly instruments. Costs provided are estimates and may be more or less when specific brand items are evaluated.

INDUSTRIAL HYGIENE LABORATORY COSTS

Instrument	*Number of Instruments*	*Approximate Cost/Unit**	*Total Cost**
Velometer Kit	1	$350.00	$350.00
Vane Anemometer	1	200.00	200.00
Thermoanemometer	1	300.00	300.00
Smoke Tubes	10 boxes	7.50	75.00
Rotameter	3	20.00	60.00
Wet Gas Meter	1	300.00	300.00
Impingers			
Large	3	38.00	114.00
Small	3	11.00	33.00
Personnel Samplers	3	240.00	720.00
Gravimetric Dust Samplers	7	50.00	350.00
Light Meter	3	70.00	210.00
Piston Pump	1	150.00	150.00
Vane Pump	1	150.00	150.00
Direct Reading Indicator Pump	3	75.00	225.00
Direct Reading Indicator Tubes	10 boxes	6.00	60.00
Oxygen Indicator	1	240.00	240.00
Mercury Detector	1	375.00	375.00
Halide Detector	1	750.00	750.00
Hydrocarbon Detector	1	650.00	650.00
Sound Level Meter	1	420.00	420.00
Combustible Gas Indicator	1	335.00	335.00
Microscope	1	500.00	500.00
		Total	$6,567.00

(In addition, it was suggested that a Lifting Training Model be purchased for the Physical Hazards Control course. The cost, at that time, was $75.00.)

*1972 cost estimate

Appendix D.3

Equipment Inventory of Housatonic Community College

List supplied by Richard B. Cooper
Associate Dean for Academic Development

Equipment List

In addition to the normal laboratory equipment of microscopes, centrifuge, etc., the College has equipped the laboratories with the following:

1—gas chromatigraph
1—flame spectrophotomer
1—infra-red spectrophotomer
1—ultra-violet spectrophotomer
12—spectronic 20's
24—pH meters
18—1,000 gram top-loading balances, to 2 decimal places
18—analytical balances, to 4 decimal places
6—geiger counters
1—quartz thermometer

Under our present NIOSH grant the College has added the following pieces of equipment:

1—TSI Model 1650 Air Velocity Meter
5—#560 respirators and filters
1—wet test meter ss 20 cu ft/hr
5—ear muffs and plugs
2—pumps deluxe Monitaire 0-10
1—Monitaire sampling kit
1—mercury vapor detector with carrying case and tubes
2—#8500 Alnor thermo anemometer
1—Ainsworth balance
1—Monitaire pump calibration unit
1—oxygen meter
3—light meters
1—Titmus vision tester, industrial model Ov7-M
1—halogenated hydrocarbon detector
15—safety helmets
50—disposable respirators
1—Scott Air-Pak
25—flexible vinyl cover goggles
1—combustible toxic gas tracer
1—gravimetric dust sampler (Cyclone)
1—halide detector
3—sound level meters and calibration kit
1—combustible gas indicator
5—aluminum asbestos heat aprons
1—carbon monoxide indicator
15—NIOSH approved dust respirators
1—Singer combustible hazards trainer
1—full face canister type gas mask
1—v.c. gas mask
2—gas mask canisters
1—chemical/gas entry suit

Appendix D.4

Equipment Inventory of Northern Virginia Community College

List supplied by George M. Burgess,
Principal Instructor and Program Head

Equipment List

Precision sound level meter and octave band analyzer
Weighted scale sound level meter
Graphic sound level recorder
Air conduction audiometer
Noise dosimeter
Sound level calibration kit
Weston Model 615 Illumination Meter
GE Light Intensity Meter
Count rate meter (Eberline Model E 140)
Dosimeter (200 MR Gamma and x-ray)
Combustible Gas indicator (MSA Model 21)
Combustible Gas Detector (MSA Model 53)
Drager Multi-gas Detector Kit
Universale Sampling Pump
Exhaust gas probe assembly
Oxygen analyzer
Oxygen indicator
Personal sampling pumps (MSA and Bendix)
Portable carbon monoxide monitor
High volume sampling pump
Vane anemometer
Velometer
Wet test meter
Analytical balance
Microscopes
WBGT Thermometers
Gas chromatagraph
Infra-red spectrometer
Rotameter
Hazardous materials trainer

Appendix D.5

Anticipated Equipment Requirements for San Diego City College

List supplied by Walter DeFelice, Jr., Coordinator

Physical Plant Requirement for a Basic Industrial Hygiene Laboratory

Instruments—Lab	Cost*
G.C., Programmable E, C, TC & CID (VARAN)	$15,000
IR, Grating Spect, Dual Beam (P.E.)	12,000
Various cells including 20M gas	5,000
AA, Dual Beam Integrating (P&E)	12,000
Various Lamps @ 100-150.00	2,800
VV, Scanning Dual Beam (B&L)	9,000
Attachments	
Recorders for above 4 @ $1500 (VARAN)	6,000
Regulators and Fittings	1,000
Phase Microscope 5 objectives (AO)	3,000
SEM, & Video Tape (ICI)	15,000

Instruments—Field	
MIRAN - II-IR & QC Loop (Wilkes)	6,000
T.C. Leak Detector	1,000
HIVOLS Assorted	1,000
Assorted Lab Glassware & Equipment	
Vac Pump, Ovens, etc.	
Sampling syringes, analytical glassware	17,000
Hoods & Safety Cabinets	6,000
General Glassware & Pipetes	
Physical Lab space divided into special areas of analysis	
TOTAL	$111,000

*Cost of equipment in 1976

APPENDIX E

RELATED JOURNALS/PERIODICALS

bstracts on Hygiene
Bureau of Hygiene and Tropical Diseases
Keppel Street
London, WC 1E, 7HT, England

Air Pollution Abstracts
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Research Triangle Park, NC 27711

American Industrial Hygiene Association Journal
American Industrial Hygiene Association
475 Wolf Ledges Parkway
Akron, OH 44311
Issue Rate: Monthly

American Journal of Epidemiology
615 North Wolfe Street
Baltimore, MD 21205

American Journal of Public Health
American Public Health Association
1015 18th Street, NW
Washington, DC 20036
Issue Rate: Monthly

American Medical News
American Medical Association
535 North Dearborn Street
Chicago, IL 60610

American Review of Respiratory Disease
American Lung Association
1740 Broadway
New York, NY 10019

Analytical Chemistry
American Chemical Society
1155 16th Street, NW
Washington, DC 20036

Annals of Occupational Hygiene
Pergamon Press, Maxwell House
Fairview Park
Elmsford, NY 10523
Issue Rate: Quarterly

Archives of Environmental Health—Preventive, Occupational, and Aerospace Medicine
American Medical Association
535 North Dearborn Street
Chicago, IL 60610
Issue Rate: Monthly

Archives of Internal Medicine
535 North Dearborn Street
Chicago, IL 60610

Archives of Pathology
American Medical Association
535 North Dearborn Street
Chicago, IL 60610

ASHRAE Journal
American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
345 East 47th Street
New York, NY 10017

British Journal of Industrial Medicine
British Medical Association
Tavistock Sq.
London WCI H9JR, England
Issue Rate: Quarterly

British Medical Journal
Tavistock Sq.
London WCI H9JR, England

Chemical Abstracts
American Chemical Society
1155 Sixteenth Street, NW
Washington, DC 20036

Chemical and Engineering News
American Chemical Society
1155 16th Street, NW
Washington, DC 20036
Issue Rate: Weekly

Chemical Engineering
McGraw-Hill Publishing Company, Inc.
P.O. Box 430
Highstown, NJ 08520

CIS Abstracts
International Labour Office
International Occupational Safety and Health Information Centre
1211 Geneva 22, Switzerland

Clinical Bulletin
Memorial Sloan-Kettering Cancer Center
1275 York Avenue
New York, NY 10021

Clinical Toxicology
Marcel Dekker, Inc.
305 East 45th Street
New York, NY 10017
Issue Rate: Bi-Monthly

Conference Board Record
Conference Board
845 Third Avenue
New York, NY 10022

Crossroads
International Safety Academy
1021 Georgia Avenue
Macon, GA 31201
Issue Rate: Monthly

Environment
Scientists' Institute for Public Information
438 North Skinner Boulevard
St. Louis, MO 63130
Issue Rate: Monthly (Except Bi-Monthly January/ February and July/ August)

Environmental Health and Safety News
Department of Environmental Health SC-34
School of Public Health and Community Medicine
University of Washington
Seattle, WA 98195
Issue Rate: Monthly

Environmental Health Perspectives
National Institute of Environmental Health Sciences
P.O. Box 12233
Research Triangle Park, NC 27709

Environmental Research
Academic Press, Inc.
111 Fifth Avenue
New York, NY 10003
Issue Rate: Quarterly

Environmental Science and Technology
American Chemical Society
1155 16th Street, NY
Washington, DC 20036
Issue Rate: Monthly

Ergonomics
Taylor and Francis, Ltd.
P.O. Box 9137
Church Street Station
New York, NY 10049
Issue Rate: Bi-Monthly

Excerpta Medica
Section 35: "Occupational Health and Industrial Medicine"
Excerpta Medica Foundation
Nassau Bldg.
228 Alexander Street
Princeton, NJ 08540
Issue Rate: Monthly

Health Laboratory Science
The American Public Health Association, Inc.
1015 Eighteenth Street, NW
Washington, DC 20036

Health Physics
Pergamon Press, Maxwell House
Fairview Park
Elmsford, NY 10523
Issue Rate: Monthly

Heating, Piping and Air Conditioning
Reinhold Publishing Corporation
600 Summer Street
Stamford, CT 06904

Index Medicus
National Library of Medicine
U.S. Department of Health, Education and Welfare
Public Health Service
National Institutes of Health
8600 Rockville Pike
Bethesda, MD 20014
(Superintendent of Documents
GPO
Washington, DC 20402)

Industrial Health & Toxicology
BioSciences Information Services
Biological Abstracts
2100 Arch Street
Philadelphia, PA 19103
Issue Rate: Monthly

Industrial Hygiene Digest
Industrial Health Foundation, Inc.
5231 Centre Avenue
Pittsburgh, PA 15232
Issue Rate: Monthly

Industrial Hygiene News Report
Flournoy and Associates
1845 West Morse Avenue
Chicago, IL 60626

Insulation Hygiene Progress Resports
Insulation Industry Hygiene Research Program
Mount Sinai School of Medicine of the
City University of New York
New York, NY 10029

Industrial Hygiene Review
Division of Industrial Hygiene
New York State Department of Labor
80 Centre Street
New York, NY 10013

International Archives of Occupation Health
Springer-Verlag
175 Fifth Avenue
New York, NY 10010
Issue Rate: Quarterly

IUD Spotlight on Health and Safety
Industrial Union Department
AFL-CIO
2457 East Washington Street
Indianapolis, IN 46201
Issue Rate: Quarterly

Job Safety and Health
Superintendent of Documents
U.S. Government Printing Office
Washington, DC. 20402

Job Safety and Health Report
Business Publishers, Inc.
P.O. Box 1067
Blair Station
Silver Spring, MD 20910
Issue Rate: Bi-Weekly

Journal of the Acoustical Society of America
Acoustical Society of America
335 East 45th Street
New York, NY 10017

Journal of the Air Pollution Control Association
Air Pollution Control Association
4400 Fifth Avenue
Pittsburgh, PA 15213
Issue Rate: Monthly

Journal of American Insurance
American Mutual Insurance Alliance
20 North Wacker Drive
Chicago, IL 60606

Journal of the American Medical Association
American Medical Association
535 North Dearborn Street
Chicago, IL 60610

Journal of Auditory Research
The C.W. Skilling Auditory Research Center, Inc.
Box M
Groton, CT 06340

Journal of Aviation, Space and Environmental Medicine
Washington National Airport
Washington, DC 20001
Issue Rate: Monthly

Journal of Occupational Medicine
Industrial Medical Association
150 North Wacker Drive
Chicago, IL 60606

Journal of the Society of Occupational Medicine
Royal College of Physicians
11 St. Andrew's Place
London NWI 4LE, England
Issue Rate: Quarterly

Journal of Toxicology & Environmental Health
Hemisphere Publishing Corporation
1025 Vermont Avenue, NW
Washington, DC 20005

Lancet
Little, Brown & Company
34 Beacon Street
Boston, MA 02106

Lighting Design and Application
The Illuminating Engineering Society
345 East 47th Street
New York, NY 10017

Medical Bulletin
Exxon Corporation and Affiliated Companies
1251 Avenue of the Americas
New York, NY 10020

National Safety News
National Safety Council
444 North Michigan Avenue
Chicago, IL 60611
Issue Rate: Monthly

New England Journal of Medicine
New England Journal of Medicine
10 Shattuck Street
Boston, MA 02115

Noise Control Engineering
Institute of Noise Control Engineering
P.O. Box 2167
Morristown, NJ 17960
Issue Rate: Quarterly

Noise Control Report
Business Publishers, Inc.
P.O. Box 1067
Blair Station
Silver Spring, MD 20910
Issue Rate: Bi-Weekly

Noise/News
Institute of Noise Control Engineering
P.O. Box 1758
Poughkeepsie, NY 12603

Nuclear Safety
United States Nuclear Regulatory Commission
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

Occupational Hazards
Occupational Hazards
614 Superior Avenue W.
Cleveland, OH 44113

Occupational Health
Macmillan Journals. Ltd.
Little Essex Street
London, WC2, England
Issue Rate: Monthly

Occupational Health & Safety
Medical Publications, Inc.
4901 Bosque Blvd.
Waco, TX 76710

Occupational Health and Safety Letter
Gershon W. Fishbin, Publisher
1097 National Press Building
Washington, DC 20004

Occupational Health Nursing
American Association of Industrial Nurses
79 Madison Avenue
New York, NY 10016

Occupational Safety and Health
Royal Society for the Prevention of Accidents
6 Buckingham Place
London, England
Issue Rate: Monthly

Occupational Safety & Health Reporter
Bureau of National Affairs, Inc.
1231 25th Street, NW
Washington, DC 20037
Issue Rate: Weekly

Occupational Safety and Health Subscription Service
Standards, Interpretations, Regulations and Procedures
U.S. Occupational Safety and Health Administration
Washington, DC
5 vols. (OSH 01 through OSH 05). Available from Government Printing Office. Catalog No. L35.6/3-1 through 5.

OSHA Up-to-Date
National Safety Council
444 North Michigan Avenue
Chicago, IL 60611
Issue Rate: Monthly

Pesticides Monitoring Journal
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402
Issue Rate: Quarterly

Plant Engineering
Technical Publishing Company
1301 S. Grove Avenue
Barrington, Il 60010

Professional Safety
American Society of Safety Engineers
Park Ridge, Il 60068

Public Health Reports
U.S. Public Health Service
Parklawn Building
5600 Fishers Lane
Rockville, MD 20852

Skin and Allergy News
American Medical News Service, Inc.
12230 Wilkins Avenue
Rockville, MD 20852

Sound and Vibration
Acoustical Publications, Inc.
27101 E. Oviatt Road
Bay Village, OH 44140

Toxicology and Applied Pharmacology
Academic Press
111 Fifth Avenue
New York, NY 10003